Combined Sewer Overflow Control Program

2004–2005 Annual Report

October 2005

King County
Department of Natural Resources and Parks
Wastewater Treatment Division

For comments or questions, contact:
Karen Huber
King County Wastewater Treatment Division
CSO Control Program
201 S. Jackson St.
KSC-NR-0512
Seattle, WA 98104-3855
206-684-1246
karen.huber@metrokc.gov

Alternative Formats Available
206-684-1280 TTY Relay: 711

Contents

Tables

Figures

Preface

This report is prepared and submitted to the Washington State Department of Ecology in accordance with the requirements established in the West Point Treatment Plant NPDES Permit[1] and in WAC 173-245-090. The report includes the following information:

- Section 1—Overview and status of the CSO control program managed by the Wastewater Treatment Division of King County's Department of Natural Resources and Parks
- Section 2—Annual volumes and frequencies of combined sewer overflows (CSOs) for the period between June 1, 2004, and May 31, 2005
- Appendices A and B—Annual reports for the Alki and Carkeek CSO Treatment Plants

[1] Permit Number WA-002918-1.

Section 1

Overview and Status of King County's CSO Control Program

The King County Wastewater Treatment Division (WTD) provides wholesale wastewater conveyance and treatment for flows from the City of Seattle and 33 other cities and sewer districts. Only the City of Seattle wastewater collection system contains combined sewers that collect both wastewater and stormwater. Seattle's collection system conveys flows to County trunks and interceptors, which then convey flows to the West Point Treatment Plant located in Discovery Park. When medium to large storm events occur, flows may exceed the capacity of the collection system pipes, resulting in combined sewer overflows (CSOs) into 38 County CSO locations that discharge to Lake Washington, Lake Union, the Ship Canal, the Duwamish River, Elliott Bay, and Puget Sound (Figure 1).

CSOs are a recognized source of water pollution that can result in temporary increases in bacterial counts and aesthetic degradation of shorelines, in long-term adverse effects on sediment quality at discharge points, and in raised public health concerns in areas where there is potential for public contact. Since the 1970s when the basic sewer system infrastructure was in place, King County has been implementing CSO control projects to improve water quality in the Seattle–King County area.

This section summarizes the evolution of King County's CSO control program and then describes the status of CSO control projects and ongoing elements of the program.

1.1 Overview of CSO Control Program

King County first formalized CSO control with the development of the *1979 CSO Control Program* (1979 Program). The 1979 Program identified nine projects to reduce the number of CSO events into freshwater (Lake Washington, Lake Union, and the Ship Canal). In 1985, the Washington State Water Pollution Control Act (RCW 90.48) introduced new regulations that required all municipalities with CSOs to develop plans for "...the greatest reasonable reduction at the earliest possible date." The County prepared the *1986 Plan for Secondary Treatment Facilities and Combined Sewer Overflow Control* (1986 Plan) to meet this requirement.

Before the 1986 Plan was implemented, the Washington State Department of Ecology (Ecology) promulgated new regulations (WAC 173-245-020) that defined "greatest reasonable reduction" to mean "control of each CSO such that an average of one untreated discharge may occur per year." The County worked with Ecology to develop an interim goal of 75 percent reduction of CSO volumes system wide by the end of 2005. The County's *Final 1988 Combined Sewer Overflow Control Plan* (1988 Plan) identified 11 CSO control projects designed to meet this interim goal.

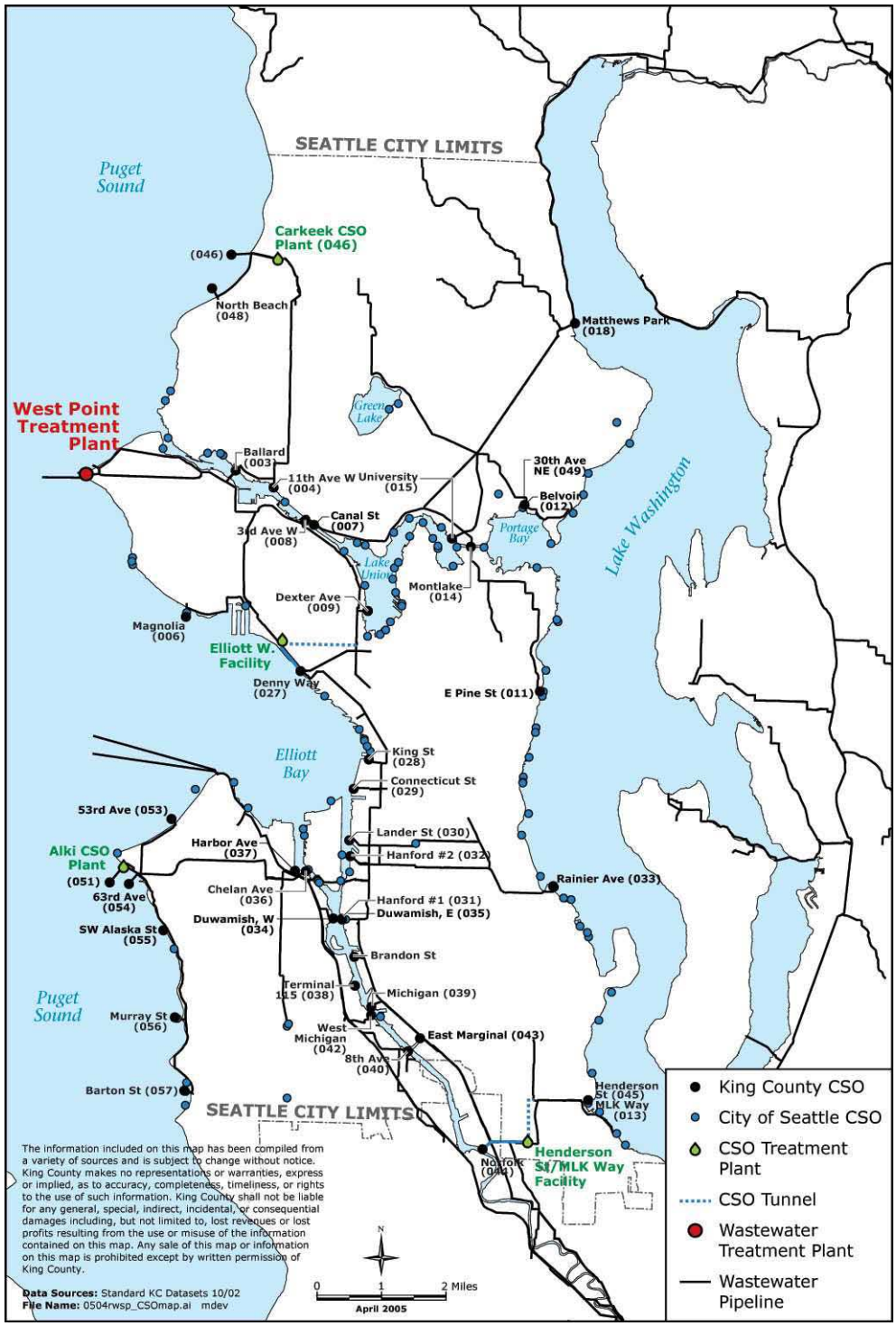

Figure 1. King County CSOs.

As part of the 1995 NPDES permit renewal for the West Point Treatment Plant, King County prepared an update and amendment to the 1988 Plan. The *1995 CSO Update* assessed the effectiveness of CSO reduction efforts to date, reevaluated priorities for control of CSO sites, and identified three control projects for completion in 1995–2000.

In November 1999, the King County Council approved *The Regional Wastewater Services Plan* (RWSP). The RWSP identifies wastewater projects to be built through 2030 to protect human health and the environment, serve population growth, and meet regulatory requirements. The RWSP included a CSO control plan that consists of the amended 1988 CSO control plan, a goal for achieving control at each CSO location by 2030,[2] and identification of 21 CSO control projects at a total cost of $566.6 million (1998 dollars) to meet this goal.

An update of the RWSP's CSO control plan—*Year 2000 CSO Control Plan Update* (2000 CSO Update)—was included in the June 2000 submission of the West Point Treatment Plant NPDES permit renewal application. The 2000 CSO Update describes King County's progress in implementing its CSO control program, documents its compliance with state and federal CSO control requirements, and identifies two large control projects—Denny Way/Lake Union and Henderson/Martin Luther King Jr. Way/Norfolk—for completion in the next 5-year NPDES permit cycle.

The Mercer Tunnel/Elliott West and Henderson Tunnel/Norfolk CSO control facilities came online in spring 2005 and will be in the startup phase through the end of 2005. On June 20, 2005, the West Point NPDES permit was modified to include requirements for these facilities. The modification set effluent limits that are similar to the limits for the Carkeek and Alki CSO Treatment Plants. The modification also requires the reevaluation of public notification approaches for the entire CSO control program and the assessment of any opportunities to provide more immediate overflow information to the public.

Work is under way on the *Year 2005 CSO Control Plan Update* (2005 CSO Update). The draft plan is expected to go to the King County Council in December 2005 and to Ecology in 2008 as part of the NPDES permit renewal application.

1.2 Status of CSO Control Projects

This section presents an overview of King County's completed, current, and planned CSO control projects. Projects began in the late 1970s. Many early projects involved sewer separation, flow diversion, and new tunnels. Most current and future projects involve construction of storage tanks and treatment facilities.

1.2.1 Completed CSO Control Projects

Tables 1 and 2 summarize CSO control projects and other projects associated with CSO control that have been completed to date.

[2] Prior to King County's adoption of the RWSP, Ecology had withdrawn the 1988 Plan's interim goal of 75 percent reduction of CSO volumes by 2005 in favor of allowing the County to prioritize control projects in terms of protection of human health rather than reduction of volumes.

Table 1. Completed CSO Control Projects

Project	Description	Completion Date	Status
Ft. Lawton Tunnel	Parallel tunnel to the West Point plant to provide greater transfer capacity.	1991	Completed.
CATAD[a]	Computer control of flows to maximize storage in pipelines.	Ongoing	Anticipated completion in 2005–2006 of implementation of upgraded computer software. Maintenance and improvement are ongoing.
Hanford/Bayview/ Lander Separation & Storage	Partial separation of the Lander and Hanford basins, and reactivation of the Bayview Tunnel. (Joint project with the City of Seattle.)	1992	Remaining control will occur under RWSP projects in 2017 (Hanford), 2019 (Lander), and 2026 (Hanford at Rainier). Lander stormwater management is ongoing.
Carkeek Transfer/CSO Treatment	Transfer of flows up to 9.2 mgd from the Carkeek basin to the West Point plant. Treatment of flows above 9.2 mgd at the Carkeek CSO plant.	Facilities online in 1994; upgrades completed in 2005	The Carkeek plant was receiving more flow than anticipated. Upgrades were made to the pumps that transfer flow to West Point to increase their capacity from 8.4 to 9.2 mgd.
University Regulator/ Densmore Drain	Separation of Densmore and I-5 stormwater, as well as Green Lake drainage.	1994	Remaining control will occur in 2015 under an RWSP project. Densmore stormwater management is ongoing. Additional work is under way on pumping and hydraulic improvements to Densmore drain.
Kingdome Industrial Area Storage & Separation	Installation in 1994 of a pipeline (used for storage) in conjunction with Seattle and WSDOT street projects. Completion by the Public Facilities District in 1999 of 60% of the Level 1 separation between Alaska Way and 3rd Ave. in conjunction with Safeco Field construction.	1994 & 1999	Remaining control will occur in 2026 under an RWSP project.
Harbor Pipeline	Installation of a pipeline to convey overflow from the Harbor Avenue Regulator Station to the West Seattle Tunnel for storage.	1996	The pipeline was put into operation in 2000–2001.
Alki Transfer/CSO Treatment	Transfer of flows up to 18.9 mgd from the Alki drainage basin to the West Point plant via the West Seattle Tunnel. Treatment of flows above 18.9 mgd at the Alki CSO plant.	1998	Additional Alki CSO plant modifications were completed in 1999.
63rd Ave. Pump Station	Diversion of overflows to the West Seattle Tunnel or Alki CSO plant.	1998	Frequency of CSO events is close to one per year. Will monitor to check actual performance.

Project	Description	Completion Date	Status
Denny Way/Lake Union	Storage and primary treatment of Lake Union flows in the Mercer Tunnel, with screening, disinfection, and discharge at Elliott West.	2005	Construction of major facilities was completed; startup is under way.
Henderson/MLK/ Norfolk	Storage, primary treatment, and disinfection of Henderson and MLK flows in the Henderson Tunnel; transfer of flows to secondary treatment plants; discharge of excess treated CSOs at Norfolk.	2005	Construction was completed; startup is under way.

[a] The Computer Augmented Treatment and Disposal System (CATAD) controls the West Point Treatment Plant collection system.

Table 2. Completed Associated Projects

Project	Description	Completion Date	Status
Renton Sludge Force Main Decommissioning	Pumping of sludge to the Elliott Bay Interceptor for conveyance to the West Point plant for processing until the South plant developed solids management capability; the decommissioning decreased solids discharge from the Interbay Pump Station at Denny during CSO events.	1988	Completed.
Denny Sediment Cap	Pilot sediment remediation project	1990	Ten-year data review of pilot remediation project is due in early 2006. Sediment remediation of area in front of original discharge is expected to be completed in 2007.
Ballinger and York Pump Stations	Construction of two new pump stations that can divert flows to and from the West Point collection system. Flows are currently diverted away from West Point during the wet season.	1992 (York); 1993 (Ballinger)	Completed.
West Point Treatment Plant Expansion	Increase of plant hydraulic capacity from 325 to 440 mgd; the increased capacity enables the conveyance and treatment of more flow from the combined sewer system.	1995	Completed.
Allentown Diversion/ Southern Transfer	Designed to offset addition of Alki flows to the Elliott Bay Interceptor; resulted in significant volume reduction at Norfolk.	1995	Completed.

Project	Description	Completion Date	Status
CSO Sediment Monitoring Program	*NPDES Overflow & Sediments:* Initial characterization monitoring to identify project priorities. *Sediment Baseline:* Sediment characterization to identify cleanup needs.	1995 & 1997	Completed.
CSO Water Quality Assessment of the Duwamish River & Elliott Bay	Complex study to determine the existing environment and the relative contribution of CSO to pollution.	1999	Completed.
North Creek Pump Station	Diversion of flow away from the West Point to the South plant collection system during wet weather.	1999	Completed.
Carkeek Overflow Reduction Study	Resulted in projects to improve operational controls and to upgrade the pumps that transfer flow to West Point to increase their capacity from 8.4 to 9.2 mgd.	2003	Study was completed in 2003; the recommended increase in pumping capacity was completed in 2005.
Norfolk Sediment Remediation[a]	Source control, dredging, and capping.	1999	Completed. A 5-year post-construction program was completed in 2005.
Duwamish/Diagonal Sediment Remediation[a]	Source control, dredging, and capping.	2004	Remediation and follow-up mitigation were completed in 2004. A 10-year monitoring program for recontamination potential is in progress.

[a] This project was done under the Elliott Bay/Duwamish Restoration Panel (EBDRP) under the consent decree to settle the 1990 litigation by National Oceanic and Atmospheric Administration (NOAA) against the City of Seattle and King County (then Metro) for natural resource damages attributed to CSOs and storm drains.

1.2.2 Current CSO Projects

In the *2000 CSO Update*, two continuing projects for CSO control were slated to be completed during the next NPDES permit cycle (approximately 5 years):

- Denny Way/Lake Union
- Henderson/Martin Luther King Jr. Way/Norfolk

Construction of major facilities for the Denny/Lake Union project was completed in spring 2005; associated construction and startup will continue through the end of the year. The project will reduce CSO discharges at the Denny Way Regulator Station from approximately 50 untreated discharges to 1 untreated discharge per year on average. City of Seattle and King County CSOs to Lake Union (east and south sides) will also be controlled. At project completion, it is predicted that there will be approximately 14 to 20 treated discharges per year through a new outfall near the Denny Way Regulator Station.

Construction of the Henderson/Martin Luther King Jr. Way (MLK)/Norfolk project was completed in May 2005. The project will control CSOs at each of the three locations. Overflows will essentially be eliminated at the MLK location. Untreated overflows at the Henderson Street Pump Station will occur approximately once every 2 years. Treated discharges at the Norfolk Regulator Station location will occur approximately four times each year.

Both of these systems are designed to operate automatically, with minimal staffing. They will operate intermittently, and operation will vary with each event. To ensure complete CSO control, procedures may be modified as experience is gained in operating these complex systems. The NPDES permit for the West Point Treatment Plant was modified on June 20, 2005, to include the new CSO control facilities in these systems. Beginning next year, annual reports, similar to the annual reports for the Alki and Carkeek CSO Treatment Plants, will be prepared for these systems and will be included as appendices to the CSO annual report.

Denny Way/Lake Union CSO Control Project

In late 1991, the City of Seattle requested that King County participate in a joint analysis of alternatives to control CSO discharges into Lake Union and into Elliott Bay at the Denny Way Regulator Station. A joint project was developed and was awarded a $35 million EPA Federal Infrastructure Grant.

In 1997, the City completed construction of improved conveyance facilities that increase wet-weather capacity in the east and south Lake Union areas. The County constructed a system that will (1) store CSO flows from Lake Union during small to moderate storms and transfer them to the West Point Treatment Plant after the storm subsides, and (2) treat CSO flows during heavy rain conditions (approximately 14 to 20 times per year) and then discharge the treated flows. Major new facilities in the system are as follows:

- Mercer Tunnel—a 6,200-foot-long, 14.66-foot-diameter tunnel under Mercer Street between Dexter Avenue North and Elliott Avenue West, providing storage, primary clarification, and conveyance
- Elliott West CSO Control Facility—a pump station and CSO treatment system at the west portal of the Mercer Tunnel, providing floatable materials removal, disinfection, and dechlorination
- Elliott West Outfall—a 96-inch-diameter outfall to discharge treated flows from the Elliott West CSO Facility into Elliott Bay at Myrtle Edwards Park near the Denny Way CSO outfall
- Extension of Denny Way CSO outfall—an extension of the existing outfall at the Denny Way Regulator Station to discharge untreated CSO flows into Elliott Bay at Myrtle Edwards Park (expected to occur about once per year)

Construction of the Mercer Tunnel and outfalls was completed in 2002. The Elliott West CSO Facility was essentially complete in spring 2005; commissioning began in April 2005. Construction of the remaining project elements is expected to be complete by the end of 2005.

As of June 1, 2005, the Mercer Tunnel has filled once, on May 10, 2005. The stored flows were transferred to West Point with no discharge from the Elliott West outfall.

Henderson/Martin Luther King Jr. Way/Norfolk CSO Control Project

At the time of adoption of the 1988 Plan, it was thought that all King County CSO locations that discharged into Lake Washington, including the Henderson Street Pump Station and Martin Luther King Jr. Way locations, had been controlled to one event per year. Subsequent observations and monitoring indicated that overflows occurred more frequently at these locations.

In 1995, the County evaluated the Henderson Street Pump Station and Martin Luther King Jr. Way CSOs and their interaction with the downstream Norfolk Regulator Station to identify interim and permanent corrective measures to control overflows. The recommended alternative was to construct a 3.2-MG storage tank/CSO treatment facility near the Norfolk Regulator Station.

During the 1997 predesign evaluation of alternatives, it was determined that a storage/treatment tunnel would be more cost-effective to build and operate than storage/treatment facilities at the Norfolk site. A storage/treatment tunnel would cause fewer adverse community impacts and would be consistent with the approach being used on the Denny Way/Lake Union CSO control project. In addition, it was determined that an earlier component of the Alki transfer—the southern transfer or Allentown diversion—could be operated to integrate with the Henderson/MLK/Norfolk project. This integrated operation would divert base flows and stored CSO flows to the South Treatment Plant at Renton, benefiting both the Norfolk Regulator Station and the Elliott Bay Interceptor.

The resulting project will control CSOs into Lake Washington from the Henderson Street Pump Station and Martin Luther King Jr. Way locations and CSOs into the lower Duwamish River from the Norfolk location. This control will be accomplished by new facilities that will (1) store CSO flows during small to moderate storms and transfer them to the South Treatment Plant after the storm subsides, and (2) treat and disinfect CSO flows during heavy rain conditions (approximately two to four times per year) and then discharge the treated flows at the Norfolk outfall to the Duwamish River. Major new facilities in the system are as follows:

- Improved Henderson Street Pump Station—a 19-mgd pump station that will transfer CSO flows from the Henderson area
- Henderson Tunnel—a 14-foot diameter, 3,100-foot-long tunnel, providing storage, treatment, and disinfection

Construction on the pump station began in November 2001; construction of the tunnel/pipeline began in July 2002. The project was completed in spring 2005. As of the end of May 2005, the new tunnel has been tested with City water but has not yet operated with combined sewage.

NPDES Permit Modification

On June 20, 2005, the NPDES permit for the West Point Treatment Plant was modified to define requirements for the Mercer Tunnel/Elliott West and Henderson Tunnel/Norfolk CSO control facilities. Effluent limits for the facilities are similar to those for the Carkeek and Alki CSO Treatment Plants (50 percent total suspended solids removal as an annual average and 0.3 mL/L/hr settleable solids as an annual average and 1.9 mL/L/hr as event maximum). Beginning in January 2006 after a brief startup period, a fecal coliform limit of 400 organisms/100 mL and chlorine residual limits will apply.

Chlorine limits are water quality–based and are a function of dilution at the acute mixing zone boundaries. At Elliott West, a dilution of 3.4 to 1 was estimated, resulting in a limit of 44 μg/L as a monthly maximum of daily average concentrations. At Norfolk—the discharge site for the Henderson Tunnel—a dilution of 1.9 to 1 was estimated, resulting in a chlorine limit of 39 μg/L as a monthly maximum of daily average concentrations. These dilution credits differ from those predicted in the facility plans and used in the designs in order to comply with evolving mixing zone development guidance.

In addition, the permit modification requires King County (also expected in the City of Seattle renewed permit) to reevaluate public notification approaches—one of the U.S. Environmental Protection Agency's Nine Minimum Controls—and assess any opportunities to provide more immediate overflow information to the public so that they can make better informed decisions about water contact safety. The County must submit a draft feasibility study report by July 1, 2006, and a final study report by July 1, 2007. The County and City will discuss the possibility of doing the study jointly, as was done for development of the original CSO Notification and Posting Program.

Carkeek Overflow Reduction Study

The Carkeek CSO Treatment Plant was placed online at the end of 1994 and was fully operational by the following wet season. Monitoring of plant operation revealed that the plant was receiving more influent than had been assumed in the design, placing the County in violation of the NPDES permit 5-year average volume limit of 14 MG per year of treated discharge. King County and the City of Seattle jointly undertook the Carkeek Overflow Reduction Study to investigate the causes of higher than anticipated flows to the Carkeek CSO Treatment Plant. The study, completed in October 2001, supplemented the 1988 *Facility Plan for the Carkeek Transfer/CSO Facilities Project*. This plan is associated with, but not a direct part of, the CSO control plan.

The study found that the service area was sending more flow to the Carkeek plant than was originally expected. The pumps that transfer flow to the West Point Treatment Plant were not designed to handle all of the area's base flow. The study recommended that the pumping capacity be increased from 8.4 to 9.2 mgd to transfer the higher base flow to West Point and that controls be implemented to prevent increased CSOs downstream at 11th Avenue NW. The recommended changes were completed in 2005.

With this new pumping rate and increased automation of the treatment plant pumping startup, it is predicted that treated discharges could occur up to 10 times per year (maximum 5-year average) and that the volume discharged could be up to 46 MG per year (maximum 5-year average). Ecology has modified the Carkeek NPDES permit limits to reflect these new maximums.

1.2.3 Future CSO Projects

Table 3 lists future CSO projects included in the RWSP. The table includes a brief description of the facilities to be constructed and a projected completion date. If approved by the King County Council, predesign will begin on the first four projects on the list—South Magnolia, Murray Street, Barton Street, and North Beach.[3] The County has been awarded State Revolving Fund loans to develop facility plans for the Murray Street, Barton Street, and North Beach projects.

The schedule shown in Table 3 may change as a result of the 2005 CSO Update.

Table 3. RWSP CSO Control Projects

CSO Project	Project Description	Year Controlled
South Magnolia	1.3-MG storage tank	2010
SW Alaska St.[a]	0.7-MG storage tank	2010
Murray Ave.	0.8-MG storage tank	2010
Barton St.	Pump station upgrade	2011
North Beach	Storage tank and pump station upgrade	2011
University/Montlake	7.5-MG storage tank	2015
Hanford	3.3-MG storage and treatment tank	2017
West Point Treatment Plant improvements	Primary and secondary enhancements	2018
Lander St.	1.5-MG storage/treatment at Hanford	2019
Michigan	2.2-MG storage and treatment tank	2022
Brandon St.	0.8-MG storage and treatment tank	2022
Chelan Ave.	4-MG storage tank	2024
Connecticut St.	2.1-MG storage and treatment tank	2026
King St.	Conveyance to Connecticut St. treatment	2026
Hanford at Rainier Ave.	0.6-MG storage tank	2026
8th Ave. S	1.0 MG storage tank	2027
West Michigan	Conveyance upgrade	2027
Terminal 115	0.5-MG storage tank	2027

[3] The SW Alaska Street project is no longer needed; updated monitoring and modeling data indicate that this CSO is already controlled.

CSO Project	Project Description	Year Controlled
3rd Ave. W	5.5-MG storage tank	2029
Ballard	1.0-MG storage tank (40% King County)	2029
11th Ave. NW	2.0-MG storage tank	2030

[a] The SW Alaska Street project is no longer needed; updated monitoring and modeling data indicate that this CSO is already controlled.

1.3 Ongoing CSO Program Elements

This section describes three ongoing CSO program elements: CATAD System Modifications, Lander and Densmore Stormwater Management Program, and CSO Notification and Posting Program.

1.3.1 CATAD System Modifications

The Computer Augmented Treatment and Disposal System (CATAD) controls the West Point Treatment Plant collection system.

Projects to enhance the use of storage capacity in existing sewers are part of ongoing improvements to the CATAD system. In 1992, storage levels behind regulator stations were raised to improve capture of CSO. Currently, a modified CSO drawdown strategy is being tested at the Interbay Pump Station. The station's wetwell level will be maintained to just above the anti-vortexing tubes. This strategy will provide storage capacity in the upper portion of the interceptor for as long as possible without the air entrainment and cavitation problems of a full drawdown. The available storage will be used when flow exceeds the allowed flow through the pump station.

Supervisory Control and Data Acquisition (SCADA) computer hardware and software at West Point was replaced with a new system to bolster the reliability of monitoring and control of offsite regulator and pump stations. The system is being tested and modified as necessary. The new hardware includes enough capacity to install and run an optimization program (predictive control) to monitor rainfall and conditions in the major trunks and interceptors, predict inflows to the sewer system, and optimize the regulation of flow through the regulators to minimize CSOs. Predictive control model development and calibration will occur in 2005–2007; a new updated control program is expected in 2007–2009.

These improvements to the CATAD system could reduce CSO volumes by as much as 150 MG per year. Additional improvements will be explored as information becomes available.

1.3.2 Lander and Densmore Stormwater Management Program

King County and the City of Seattle jointly manage stormwater discharges in the Lander and Densmore drainage basins that occur as the result of County sewer separation projects. This ongoing management program includes Densmore-specific requirements under the NPDES

municipal stormwater permit. Program elements include source control, baseline sampling of stormwater discharges, and inspections. As specified in a local agreement between the City of Seattle and King County, the City maintains the stormwater system, develops compliance schedules, and manages enforcement actions.

The Lander stormwater diversion gate is operated by the West Point SCADA system. The diversion gate has not been operating since January 2004 because of the CATAD system upgrade. The existing gate is corroding and will be replaced with a new gate in the first quarter of 2006.

The Densmore drain system was built to reduce CSOs at the University Regulator Station. It collects stormwater from the Haller Lake area and Green Lake drainage that had previously entered the combined sewer system. The Densmore drain runs from Green Lake to Lake Union. A pump station and discharge to Lake Union are located just west of the I-5 bridge. In the event of pump failure, high-level weirs allow stormwater to discharge to the combined sewer to prevent damage to Green Lake park facilities.

The Densmore drain system began running in 1995, but its operation has not resulted in the expected CSO reduction, mainly because of hydraulic, mechanical, and electrical problems. Pump 1 was taken out of service in June 2004 for repair of electrical problems in the motor. Pump 2 was taken out of service in April 2004 for repair of moisture in the motor. Pumps 1 and 2 are now back in service. Pump 3 operated only on a limited basis before January 2004 because of surges, pressure buildup, and pumping capacity problems; the pump was taken out of service in January 2004 when moisture entered its motor. Pump 3 will be repaired early in 2006 but cannot be used until the stormwater system hydraulic improvements are completed in summer 2006.

In addition, Seattle Parks and Recreation maintenance staff have been removing the stoplogs at the drains from the lake to the combined sewer, allowing the lake to again drain to the sewer. These removable stoplogs had been installed as a means to temporarily reopen the connection to the combined sewer in the unlikely event that the Densmore drain did not provide adequate lake level control. The stoplogs have been repeatedly removed as a precautionary measure in situations where the drain is working satisfactorily. The removals have continued despite ongoing negotiations with Seattle Parks and Recreation, the installation of locks and signage, and the signing of formal agreements. Negotiations will resume soon with Seattle Parks and Recreation's new Green Lake manager.

1.3.3 CSO Notification and Posting Program

The King County Department of Natural Resources and Parks, Public Health–Seattle & King County, and Seattle Public Utilities jointly developed and are implementing a CSO Notification and Posting Program. This Ecology-approved program meets state and federal requirements for public notification and provides information to the community regarding the possible health impacts of CSOs. Program elements include a phone number for the public to leave messages for Public Health–Seattle & King County on questions concerning CSOs,

warning signs posted at King County and City of Seattle CSO locations, a brochure, a Web site, and other outreach efforts. The warning signs include a graphic and description of a CSO, the information phone number, and a CSO number assigned to each site that corresponds to its NPDES discharge serial number.

The recently modified NPDES permit requires the County to conduct a study to determine the feasibility of providing more immediate notification of overflows, including the feasibility of providing a Web-based system. A draft report is due to Ecology July 1, 2006; a final report is due July 1, 2007. The County and City will discuss the possibility of doing the study jointly, as was done for development of the original CSO Notification and Posting Program.

1.3.4 CSO Management Program

This section describes projects at three CSO locations—Brandon Street, Kingdome, and Montlake—that were identified and started in 2004 as part of the annual review of CSO program data. The evaluation of different operational strategies for the Duwamish and West Seattle Pump Stations is also described.

Brandon Street CSO

A review of overflow data showed that the Brandon Street CSO location overflowed even though there was capacity in the Elliott Bay Interceptor (EBI). A project was initiated in 2004 to replace the 12-inch-diameter pipe leading from the Brandon Street Regulator Station to the EBI with a 30- to 36-inch-diameter pipe. The project should significantly reduce the frequency of overflows. Construction is scheduled to be completed in March 2006, and closeout in July 2006.

Kingdome CSO

In fall 2004, inspections done for preparation of the 2005 CSO Update raised questions about the operation of the Kingdome regulator. This regulator was built as part of a two-phased separation project in the Kingdome area. The County built the first phase, and contractors for construction of Safeco Field completed the second phase. After project completion, combined flows were diverted to the new Kingdome Regulator Station. The old Connecticut Regulator Station was left to provide a low-flow diversion for a stormwater-only discharge through the Connecticut outfall. The City of Seattle owns and operates the remaining stormwater discharge through the outfall.

The inspections revealed that flow monitors shown on drawings had not been installed. In November 2004, flow monitors were placed in service and began providing data. Projects to improve gate controls and decrease saltwater intrusion are under way. The inspections also showed possible sanitary connections to the stormwater line. The City was informed and provided with inspection reports and as-built drawings. As of the time of this report, the City is moving forward to identify corrections.

Montlake CSO

The frequency of overflows at the Montlake CSO location had risen from a 1 per year for the years 1999–2002 to 11 and 6 per year for the years 2002–2003 and 2003–2004 respectively. An investigation of the line showed that the Montlake siphon was obstructed. A complex cleaning effort was completed in December 2004. The obstruction did not consist of rocks and debris as had been expected. Instead, it consisted of a dense mass of hardened organic material that obstructed one-half to three-quarters of the siphon diameter. The mass was broken up and removed, and a sample was sent to the lab. Since the cleaning, the number of overflows has decreased significantly. During the 2004–2005 CSO reporting period, 73 percent of the approximately 38 MG that overflowed at this location occurred prior to the cleaning. Discovery of this obstruction has prompted the County to accelerate its inspections of other siphons in the system.

Duwamish and West Seattle Pump Stations

Four incidents of street flooding immediately downstream of the Duwamish Pump Station occurred between 1998—when flows from the West Seattle Tunnel began entering the EBI—and 2001. Changes in the pump station's operation were made to prevent the flooding, although it was recognized that these changes carried the risk of increased CSOs. Ongoing review raised concerns that existing monitors were not accurately capturing the effects of these system changes. Investigation indicated that computerized signals from the monitors had been lost and that values of "no overflow" that were being reported actually meant "no data." The replacement of the West Point SCADA computer hardware and software have corrected this problem (see Section 1.3.1, CATAD Modifications). As an added precaution, portable monitors were installed to help better characterize conditions at the pump station and siphons.

The current operational strategy at the West Seattle Pump Station may also be contributing to the flooding downstream of the Duwamish Pump Station—possibly putting this formerly controlled CSO back into uncontrolled status. The West Seattle Tunnel gate is set to send less flow to the Alki plant and more to the West Point plant than was intended in the original Alki plant design. The purpose of this strategy was to take advantage of the opportunity presented by the extra capacity in the West Seattle Tunnel. To help remedy the overflows at the Duwamish Pump Station, a new strategy will be implemented to adjust the flow split between the Alki plant and the West Seattle Tunnel so that it is closer to the original design. The new strategy will involve throttling back the West Seattle Pump Station when flows at the Duwamish Pump Station reach a certain level and then storing Alki flows in the tunnel. The Alki plant will operate more often but still within permit limits. Because the East Division operates the Alki plant and the 63rd Street Pump Station and the West Division operates the Harbor Avenue Regulator Station and the West Seattle and Duwamish Pump Stations, work in 2004–2005 focused on upgrading sensors so that each division can monitor the same information and make joint decisions. In 2005–2006, changes to the operating strategy will be implemented and evaluated.

Section 2

Summary of CSO Volumes and Frequencies

King County monitors rainfall and the frequencies and volumes of both untreated and treated CSOs at its regulator and pump stations in the Seattle area. This section presents the results of this monitoring for the 2004–2005 CSO year. It also describes the programs that the County has in place to comply with the U.S. Environmental Protection Agency's (EPA's) Nine Minimum Controls.

2.1 Annual Rainfall

As shown in Table 4, rainfall measured for the 2004–2005 CSO year was 30.48 inches as an average over local rain gauges; this is 91 percent of the baseline average of 33.5 inches per year. Rain gauge maintenance and calibration have improved. The few problems that occurred were at the King Street and Rainier Avenue gauges (Table 4).

Table 4. 2004–2005 Rainfall at Pump and Regulator Stations (in inches)

Station	2004							2005					2004-2005 Total
	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	
Ballard	0.56	0.23	2.74	1.55	2.61	2.43	4.61	3.24	0.91	3.07	2.82	2.84	27.61
Denny Local	0.25	0.31	3.39	1.72	2.07	2.56	5.01	3.52	0.95	3.34	2.9	2.76	28.78
Denny Way/Lake Union	0.6	0.1	3.55	1.69	1.99	2.43	4.64	3.35	0.88	3.21	2.8	2.62	27.86
Kenmore	0.67	0.43	2.78	2.05	2.67	3.21	5.09	2.59	1.82	3.9	3.15	2.49	30.85
King Street	0.21	0.02	3.77	1.1[(a)]	1.58	0.18[(a)]	5.09	3.75	0.84	3.35	1.08[(a)]	2.78	23.75
Marginal Way, E.	0.51	0.28	2.67	2.22	1.71	2.45	4.43	3.54	1.19	3.15	2.8	3.59	28.54
Matthews Park	0.78	0.36	3.03	2.39	2.82	3.26	5.36	3.07	1.39	3.83	3.05	2.83	32.17
Pine Street, E.	0.53	0.3	5.18	2.19	2.07	2.92	4.14	3.46	1.05	3.67	3.91	3.68	33.1
Rainier Avenue	0.48	0.23	3.69	2.2	2.18	3.28	5.39	3.82	1.22	3.38	0.97[(a)]	3.65	30.49
University	0.82	0.26	3.66	2.23	2.41	3.33	5.69	3.73	1.16	3.65	3.32	3.63	33.89
Average	0.54	0.25	3.45	2.03	2.21	2.87	4.95	3.41	1.14	3.46	3.09	3.09	30.48
Total	5.41	2.52	34.46	19.34	22.11	26.05	49.45	34.07	11.41	34.55	26.8	30.87	297.04

[(a)] The month's data are incomplete because of a malfunction of the rainfall gauges.

2.2 Annual Untreated CSO Events

Figure 1 on page 2 shows the locations of existing permitted King County CSO discharges and the discharge serial numbers (DSNs) used in Tables 5 and 6 below.

West Point's CATAD system monitors the volume and frequency of CSOs at regulator and pump stations that have the ability to make adjustments in CSO flows. The CATAD system divides the area into three service areas: the Southern Service Area (south of the Ship Canal), the Northern Service Area (north of the Ship Canal including the Montlake and Dexter Regulator Stations), and the Alki Service Area.

Portable flow meters are deployed at the six CSO locations not currently monitored by CATAD: 11th Avenue NW, SW Alaska Street, Hanford at Rainier, South Magnolia, North Beach Pump Station, and Terminal 115. The portable flow meters at Henderson Street Pump Station and Martin Luther King Jr. Way overflows were removed as part of the Henderson/Martin Luther King Jr. Way/Norfolk CSO project. Overflows from these upgraded facilities will be monitored by CATAD. In 2004, portable flow meters were temporarily placed at the forebay and discharge sides of the Duwamish Pump Station siphons to supplement monitoring of overflows at these locations.

In fall 2004, inspections done for preparation of the 2005 CSO Update raised questions about the operation of the Kingdome Regulator Station. This regulator was built as part of a two-phased separation project in the Kingdome area. The County built the first phase, and contractors for the construction of Safeco Field completed the second phase. The inspections revealed that flow monitors shown on drawings had not been installed. In November 2004, portable flow monitors were placed in service and began providing data.

2.2.1 Untreated CSO Volumes

As shown in Table 5, the total volume of untreated CSOs for 2004–2005 was 702.50 MG (541 MG in the South Service Area; 154 MG in the North Service Area; and 7 MG in the Alki Service Area). This volume represents a 71 percent reduction over the 1981–1983 baseline of 2,339 MG.

Figure 2 illustrates the progress King County has made in CSO volume reduction as compared to total annual rainfall over time. While a somewhat reasonable relationship between total rainfall and total CSO volume can be computed, large and/or intense storms can dramatically impact CSO volume, contributing most of the year's CSO volume. This impact was evident in the 2004–2005 season when approximately one-third of the annual volume overflowed during the storm of January 17–20. About 2.5 inches of rain fell on those days, with 1.7 inches falling on the January 17 alone.

Table 5. 2004–2005 CSO Volume Summary (in million gallons)

Station	DSN	Service Area	2004							2005					2004–2005 Total	1981–1983 Baseline [a]
			Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May		
11th Ave. NW [b]	004	North	<0.01	<0.01	0.86	<0.01	<0.01	0.63	0.06	0.38	0.05	0.06	0.07	<0.01	2.11	
30th Ave. NE	049	North	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<1
3rd Ave. W	008	North	<0.01	<0.01	13.74	<0.01	<0.01	2.17	0.30	2.30	0.02	0.45	<0.01	<0.01	18.98	106
53rd Ave. SW	052	Alki	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<1
63rd Ave. PS	054	Alki	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	2.31	<0.01	<0.01	<0.01	<0.01	2.31	10
8th Ave. S/ W. Marginal Way	040	South	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	8
Alaska St., SW [b]	055	Alki	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<1
Ballard	003	North	<0.01	<0.01	0.24	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.24	95
Barton St.	057	Alki	<0.01	<0.01	0.18	0.99	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.77	1.94	8
Belvoir	012	North	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<1
Brandon St.	041	South	<0.01	<0.01	0.41	0.36	0.13	0.91	1.81	6.90	0.58	2.41	1.07	3.11	17.69	64
Canal St.	007	North	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	1
Chelan Ave.	036	South	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.94	<0.01	<0.01	<0.01	<0.01	0.94	61
Denny Way	027	South	<0.01	<0.01	38.40	6.00	19.43	29.12	60.34	78.66	16.81	41.55	19.87	<0.01	310.18	502
Dexter	009	North	<0.01	<0.01	41.17	0.18	<0.01	3.89	0.30	3.28	0.20	0.09	<0.01	0.23	49.34	24
Duwamish P.S.	034	South	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	3.94	<0.01	<0.01	<0.01	<0.01	3.94	<1
Hanford (total)	031/2	South	<0.01	<0.01	7.06	0.84	2.34	5.70	18.42	24.13	2.65	11.55	5.36	1.84	79.88	644
Hanford #1 (Hanford @ Rainier) [b]			*<0.01*	*<0.01*	*0.21*	*<0.01*	*<0.01*	*0.04*	*0.15*	*0.67*	*<0.01*	*<0.01*	*0.04*	*<0.01*	*1.10*	
Hanford #2			*<0.01*	*<0.01*	*6.85*	*0.84*	*2.34*	*5.66*	*18.27*	*23.46*	*2.65*	*11.55*	*5.33*	*1.84*	*78.78*	
Harbor Ave.	037	South	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	36
Henderson [b]	045	South	<0.01	<0.01	<0.01	<0.01	<0.01	0.06	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.06	15
Kingdome	029	South	NM	NM	NM	NM	NM	<0.01	1.26	18.45	2.74	5.91	<0.01	0.16	28.51	90
King Street	028	South	<0.01	<0.01	5.56	0.15	0.79	2.91	2.87	6.55	0.76	3.64	0.77	0.13	24.13	55
Lander II St.	030	South	<0.01	<0.01	1.28	<0.01	0.61	3.90	8.58	15.16	0.34	3.56	0.22	<0.01	33.64	143
Magnolia, S. [b]	006	South	<0.01	<0.01	3.78	0.03	0.28	<0.01	3.86	7.86	1.04	4.39	1.90	1.85	24.99	14
Marginal Way, E.	043	South	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<1
Matthews Park	018	North	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<1
Michigan	039	South	<0.01	<0.01	0.01	<0.01	<0.01	<0.01	0.28	3.06	<0.01	0.03	<0.01	1.90	5.28	190

Station	DSN	Service Area	2004							2005					2004–2005 Total	1981–1983 Baseline [a]
			Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May		
Michigan, W.	042	South	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.52	<0.01	<0.01	<0.01	0.02	0.54	2
MLK Jr. Way [b]	013	South	<0.01	<0.01	0.04	0.20	<0.01	<0.01	0.63	9.04	0.30	0.36	<0.01	<0.01	10.58	60
Montlake	014	North	<0.01	<0.01	20.39	<0.01	<0.01	6.01	1.15	7.88	0.55	1.74	<0.01	0.14	37.87	32
Murray Ave.	056	Alki	<0.01	<0.01	<0.01	0.32	<0.01	<0.01	0.01	1.35	<0.01	<0.01	<0.01	0.76	2.44	6
Norfolk St.	044	South	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	39
North Beach [b]	048	North	<0.01	<0.01	0.44	<0.01	<0.01	0.67	0.28	0.27	0.02	0.04	0.24	0.06	2.02	6
Pine, E St.	011	North	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<1
Rainier Ave.	033	South	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<1
Terminal 115 [b]	038	South	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	1.11	<0.01	<0.01	<0.01	<0.01	1.11	2
University	015	North	<0.01	<0.01	17.63	<0.01	<0.01	11.78	4.31	8.65	<0.01	1.39	<0.01	<0.01	43.75	126
Total			**0.00**	**0.00**	**151.19**	**9.07**	**23.58**	**67.75**	**104.46**	**202.74**	**26.08**	**77.15**	**29.51**	**10.97**	**702.50**	**2339.0**
2004-2005 Rainfall Average (historical average in inches)			**0.54**	**0.25**	**3.45**	**2.03**	**2.21**	**2.87**	**4.95**	**3.41**	**1.14**	**3.46**	**3.09**	**3.09**	**30.48**	**37**
CSO Plants																
Alki Plant	051	Alki	0	0	0	0	0	0	0	20.4	0	0	0	0	20.4	108 [c]
Carkeek Plant	046	North	0	0	0.03	0	0	0.87	1.38	1.76	0	0	0	0	4.04	46 [c]

NM = not monitored

[a] Baselines for CSO volumes will occasionally be revised as improvements are made to the computer modeling system to provide more accurate projections on historical and future conditions.

[b] Portable flow meters; not currently monitored by CATAD.

[c] NPDES permit limit.

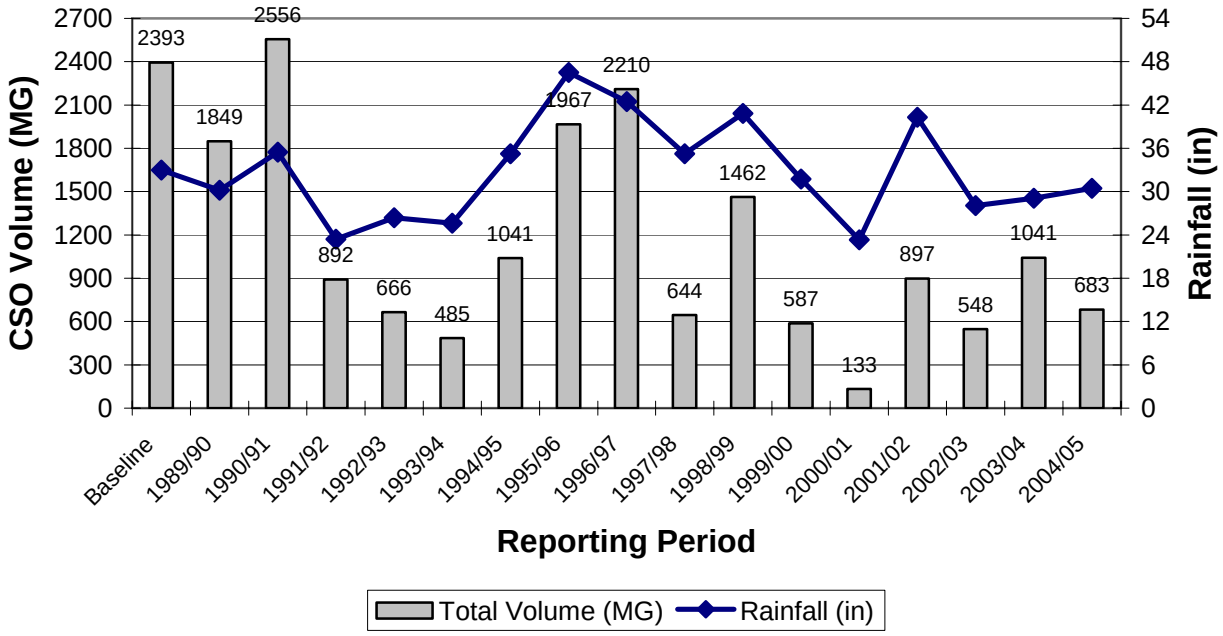

Figure 2. Annual CSO Volume Versus Total Rainfall (1989–1990 through 2004–2005)

2.2.2 Untreated CSO Frequencies

As shown in Table 6, there were a total of 198 untreated CSO events in 2004–2005 (138 events in the South Service Area; 46 events in the North Service Area; and 14 events in the Alki Service Area). The number of CSO events represents a 58 percent reduction in frequency over the 1981–1983 baseline of 471 overflows.

The modified NPDES permit requires that the County provide the 5-year moving average of untreated CSOs at controlled facilities, identified in the permit as the Carkeek, Alki, Mercer Tunnel/Elliott West, and Henderson Tunnel/Norfolk CSO Treatment Plants. For the wet seasons during the period from June 2000 through May 2005, the following average of "untreated" (poorly treated) discharges were reported for the purposes of calculating compliance with average annual total suspended solids percent removal and settleable solids permit limits:

- Carkeek—less than 1 event per year
- Alki—less than 1 event per year
- Mercer Tunnel/Elliott West—has not yet discharged
- Henderson Tunnel/Norfolk—has not yet discharged

Table 6. 2004–2005 CSO Event Frequency Summary (based on a 24-hour inter-event interval)

Station	DSN	Service Area	2004							2005					2004–2005 Total	1981–1983 Baseline [a]
			Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May		
11th Ave. NW [b]	004	North	0	0	1	0	0	1	1	2	1	1	1	0	8	16
30th Ave. NE	049	North	0	0	0	0	0	0	0	0	0	0	0	0	0	<1
3rd Ave. W.	008	North	0	0	1	0	0	1	1	1	1	1	0	0	6	17
53rd Ave. SW	052	Alki	0	0	0	0	0	0	0	0	0	0	0	0	0	<1
63rd Ave. PS	054	Alki	0	0	0	0	0	0	0	1	0	0	0	0	1	2
8th Ave./W. Marginal Way	040	South	0	0	0	0	0	0	0	0	0	0	0	0	0	6
Alaska St. SW [b]	055	Alki	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Ballard	003	North	0	0	1	0	0	0	0	0	0	0	0	0	1	13
Barton	057	Alki	0	0	1	2	0	0	0	0	0	0	0	2	5	9
Belvoir	012	North	0	0	0	0	0	0	0	0	0	0	0	0	0	<1
Brandon St.	041	South	0	0	3	3	2	2	3	1	1	2	5	5	27	36
Canal St.	007	North	0	0	0	0	0	0	0	0	0	0	0	0	0	<1
Chelan	036	South	0	0	0	0	0	0	0	1	0	0	0	0	1	7
Denny Way	027	South	0	0	3	2	2	1	5	1	1	3	3	0	21	32
Dexter	009	North	0	0	1	2	0	1	1	1	1	1	0	1	9	15
Duwamish P.S.	034	South	0	0	0	0	0	0	0	1	0	0	0	0	1	<1
Hanford (total)	031/2	South	0	0	4	1	2	2	4	2	1	1	3	1	21	58
Hanford #1 (Hanford @ Rainier) [b]			*0*	*0*	*1*	*0*	*0*	*1*	*2*	*1*	*0*	*0*	*1*	*0*	*6*	
Hanford #2			*0*	*0*	*3*	*1*	*2*	*1*	*2*	*1*	*1*	*1*	*2*	*1*	*15*	
Harbor Ave.	037	South	0	0	0	0	0	0	0	0	0	0	0	0	0	30
Henderson [b]	045	South	0	0	0	0	0	1	0	0	0	0	0	0	1	12
Kingdome	029	South	NM	NM	NM	NM	NM	0	2	2	1	1	0	1	7	29
King Street	028	South	0	0	3	1	2	1	2	1	1	1	2	3	17	16
Lander II St.	030	South	0	0	1	0	1	1	2	1	1	1	1	0	9	26
Magnolia, S. [b]	006	South	0	0	2	1	2	0	3	2	1	1	4	2	18	25
Marginal, E.	043	South	0	0	0	0	0	0	0	0	0	0	0	0	0	<1
Matthews Park	018	North	0	0	0	0	0	0	0	0	0	0	0	0	0	<1
Michigan St.	039	South	0	0	1	0	0	0	2	1	0	1	0	1	6	34

Station	DSN	Service Area	2004							2005					2004–2005 Total	1981–1983 Baseline [a]
			Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May		
Michigan, W.	042	South	0	0	0	0	0	0	0	1	0	0	0	1	2	5
MLK Jr. Way [b]	013	South	0	0	1	1	0	0	1	1	1	1	0	0	6	16
Montlake	014	North	0	0	1	0	0	1	1	1	1	1	0	1	7	6
Murray Ave.	056	Alki	0	0	0	2	0	0	1	2	0	0	0	3	8	5
Norfolk St.	044	South	0	0	0	0	0	0	0	0	0	0	0	0	0	20
North Beach [b]	048	North	0	0	2	0	0	1	1	2	1	1	1	1	10	18
Pine St., E	011	North	0	0	0	0	0	0	0	0	0	0	0	0	0	<1
Rainier Ave.	033	South	0	0	0	0	0	0	0	0	0	0	0	0	0	<1
Terminal 115 [b]	038	South	0	0	0	0	0	0	0	1	0	0	0	0	1	4
University	015	North	0	0	1	0	0	1	1	1	0	1	0	0	5	13
Total			**0**	**0**	**26**	**14**	**11**	**14**	**31**	**27**	**13**	**18**	**20**	**22**	**198**	**471.0**
2004-2005 Rainfall Average (historical average in inches)			**0.54**	**0.25**	**3.45**	**2.03**	**2.21**	**2.87**	**4.95**	**3.41**	**1.14**	**3.46**	**3.09**	**3.09**	**30.48**	**37**
CSO Plants																
Alki Plant	051	Alki	0	0	0	0	0	0	0	1	0	0	0	0	1	29 [c]
Carkeek Plant	046	North	0	0	1	0	0	1	1	1	0	0	0	0	4	8 [c]

NM = not monitored.

[a] Baselines for CSO frequencies will occasionally be revised as improvements are made to the computer modeling system to provide more accurate projections on historical and future conditions.

[b] Portable flow meters; not currently monitored by CATAD.

[c] NPDES permit limit.

2.3 Annual Treated CSO Events

This section provides information on the frequency and volume of CSOs discharged from the West Point, Alki, and Carkeek Treatment Plants—the three King County facilities that provide primary treatment of CSOs.

2.3.1 West Point Treatment Plant

In addition to secondary treatment of up to 300 mgd of base wastewater flows (defined as 2.25 times the average wet-weather flow of 133 mgd), the West Point Treatment Plant provides CSO treatment (equivalent to primary treatment) for flows between 300 mgd and the peak of 440 mgd. Combined sewer flows that would otherwise overflow at points around the combined system are transferred to the West Point Treatment Plant. After receiving CSO treatment, these flows are mixed with secondary effluent for disinfection, dechlorination, and discharge from the deep marine outfall. The resulting effluent must meet secondary effluent quality limits.

Table 7 shows the CSO treatment days and the volumes of flow receiving CSO treatment. For the 2004–2005 CSO year, there were 19 occurrences totaling 351.78 MG of treated CSO discharges from West Point.

Table 7. West Point Annual CSO Treatment Summary

Month	Day	CSO Treatment Volume (MG)
August 2004	6	2.03
	21	11.63
	22	26.52
September 2004	10	5.75
October 2004	8	5.85
	17	3.93
November 2004	2	43.5
December 2004	7	10.67
	9	25.00
	10	55.58
	13	2.08
January 2005	17	48.44
	18	22.00
February 2005	6	14.00
March 2005	19	2.90
	26	41.00
April 2005	3	7.30
	16	13.80
May 2005	9	9.80
Total	**19**	**351.78**

2.3.2 Alki and Carkeek CSO Treatment Plants

In addition to the CSO discharges from the West Point Treatment Plant, King County operated two CSO-only treatment facilities in 2004–2005: the Alki and Carkeek CSO Treatment Plants. For the 2004–2005 CSO year, Alki had one treated discharge event with a total volume of 20.4 MG and Carkeek had four treated discharge events with a total volume of 4.04 MG. The appendices to this report give detailed information on each CSO treatment plant.

2.3.3 New CSO Treatment Facilities

Construction of two other CSO treatment facilities was essentially completed in 2005—Mercer Tunnel/Elliott West and Henderson Tunnel/Norfolk facilities. Startup will continue through the end of the year. Reports similar to those provided for the Alki and Carkeek CSO Treatment Plants will be prepared for the new facilities and will be appended to the 2005–2006 CSO report.

2.4 Programs to Meet EPA's Nine Minimum Controls

King County has implemented a number of programs to satisfy the requirements of the Nine Minimum Controls, which are a part of EPA's codified CSO Control Policy. These programs are summarized in Table 8.

In spring 2004, Ecology inspected the County CSO locations, reviewed their operation and plans for control, and affirmed that the County's programs complied with EPA's Nine Minimum Controls. Ecology requested that CSO facilities be inspected for the presence of floatables and that results of these inspections be briefly reported in future annual reports. Procedures to document observations in each site log were established but were not fully implemented. Better follow-up, or a different approach, is under discussion for the current period.

As shown in the Table 8, the 2005 modifications of the West Point NPDES permit contain a new requirement for the Public Notification and Posting Program.

Table 8. King County's Compliance with EPA's Nine Minimum Controls

Nine Minimum Controls	King County Compliance Effort
Proper operation and regular maintenance programs for the sewer system and CSOs	King County regularly maintains CSO outfalls, regulator stations, and pump stations through the West Point Treatment Plant, South Treatment Plant, and collection system maintenance divisions. Proper facility operation is managed by West Point staff using CATAD.[a] Collection system staff inspect sewers on a specified schedule and perform corrective actions when deficiencies are found. Maintenance schedules and records of visits are available for inspection upon request.
Maximize use of collection system for storage	CATAD manages regulator stations to maximize flows in interceptors and to store excess flows in large trunk sewers.

Nine Minimum Controls	King County Compliance Effort
Review and modification of pretreatment requirements to ensure that CSO impacts are minimized	King County's Industrial Waste Program issues permits that set limits on the chemical contents of industrial discharges. The program also includes monitoring and permit enforcement, education, and technical assistance to businesses on appropriate waste pretreatment and disposal techniques. King County also helps fund the Local Hazardous Waste Management Program. Current water quality assessment and sediment management plan data indicate that there is no need for CSO-specific pretreatment program modifications.
Maximization of flow to secondary treatment plant for treatment	CATAD is used to maximize flow to the West Point Treatment Plant by operation of regulator and pump stations. All analysis for CSO control project alternatives include varying levels of storage and transfer to the secondary treatment plants.
Elimination of CSOs during dry weather	King County's maintenance and operation programs focus on preventing dry-weather overflows. Dry-weather overflows may occur as a result of equipment malfunction or loss of power. The conveyance system is monitored through CATAD, and corrective action is taken immediately if a problem occurs. Equipment problems are immediately reviewed, and repair or replacement activity is undertaken in a timely manner. Dry-weather overflows are reported to Ecology as sanitary sewer overflows.
Control of solid and floatable materials in CSOs	City of Seattle street sweeping and catch basin maintenance limit introduction of floatable materials to sewers. Procedures to record observations of floatable materials are being revisited.
Pollution prevention programs to reduce contaminants in CSOs	King County has implemented both the Industrial Waste Program and the Local Hazardous Waste Management Program to reduce discharge of chemicals and other substances that adversely impact the environment and the wastewater treatment process.
Public notification program to ensure that public receives adequate notice of CSO events and impacts	King County has developed a CSO Notification and Posting Program as a joint project with the City of Seattle and Public Health–Seattle & King County. This program includes posting signs at publicly accessible CSO locations, an information line, Web site, brochure, and other public outreach activities. The recently modified NPDES permit requires the County to conduct a study to determine the feasibility of providing more immediate public notification of overflows, including the possibility of providing a Web-based system. A draft report is due to Ecology July 1, 2006; a final report is due July 1, 2007. The County and City will discuss the possibility of doing the study jointly, as was done for development of the original CSO Notification and Posting Program.
Monitoring to effectively characterize CSO impacts and the efficacy of CSO controls	Under the 1988 CSO Plan, King County's sampling program (now complete) included collecting data for five CSO sites per year. The King County 1999 *CSO Water Quality Assessment* found that the majority of risks to people, wildlife, and aquatic life would not be reduced by removal of CSOs because most risk-related chemicals come from sources other than CSOs. King County may undertake additional sampling on completion of specific CSO control projects.

[a] The Computer Augmented Treatment and Disposal System (CATAD) controls the West Point Treatment Plant collection system.

Appendices

Appendix A. Alki CSO Plant Annual Report, June 2004–May 2005

Appendix B. Carkeek CSO Plant Annual Report, June 2004–May 2005

Appendix A.
Alki CSO Plant Annual Report
June 2004– May 2005

This document constitutes the fifth annual report of the Alki plant as a CSO facility. The facility currently operates under Washington State Department of Ecology permit number WA-0029181-1 issued to the West Point Treatment Plant, effective January 1, 2004 to December 31, 2008. Under this permit, there are interim and final permit criteria to be met. Interim permit parameters are effective January 1, 2004 through December 31, 2005. Starting Jan. 1, 2006, additional permit limits for total residual chlorine and fecal coliform go into effect.

Tables 1 and 2 summarize the interim and final permit limits for the Alki CSO facility.

Table 1. Interim Permit Limits (January 1, 2004 to December 31, 2005).

Parameter	Discharge Limitations (Monthly)	Discharge Limitations[a] (Yearly Average)	Discharge Limitations[b] (Long-term Average)
Total Suspended Solids Removal Efficiency[c]	NA	50%	NA
Settleable Solids, ml/l/hr	1.9 Maximum	0.3	NA
Number of Events per year	NA	NA	29/year
Average Volume per year, million gallons	NA	NA	108 million gallons/year
[a] The yearly limitations will be calculated using per-event data points. Data shall be collected and reported on a schedule concurrent with the annual CSO report, June 1 to May 31, to include the entire wet season for purposes of determining compliance with these limitations.			
[b] Long-term average will be calculated using data collected over a full permit cycle. Data shall be collected and reported for the period of the permit cycle prior to permit renewal.			
[c] The total removal efficiency for TSS is to be calculated on a mass balance basis as the percent of solids captured at the CSO Treatment Plant and then permanently removed at the West Point Treatment Plant based on the estimated removal efficiency at West Point.			

Table 2. Final Permit Limits (January 1, 2006 through the end of the permit).

Parameter	Discharge Limitations (Monthly)	Discharge Limitations[a] (Yearly Average)	Discharge Limitations[b] (Long-term Average)
Total Suspended Solids Removal Efficiency[c]		50%	
Fecal Coliform Bacteria	1700/100 mL geometric mean	NA	NA
Settleable Solids, ml/l/hr	1.9 Maximum	0.3	NA
Number of Events per year	NA	NA	29/year
Average Volume per year,	NA	NA	108 million

Parameter	Discharge Limitations (Monthly)	Discharge Limitations[a] (Yearly Average)	Discharge Limitations[b] (Long-term Average)
million gallons			gallons/year

Parameter	Average Monthly	Maximum Daily[d]
Total Residual Chlorine	NA	290µg/L

[a] The yearly limitations will be calculated using per-event data points. Data shall be collected and reported on a schedule concurrent with the annual CSO report, June 1 to May 31, to include the entire wet season for purposes of determining compliance with these limitations.

[b] Long-term average will be calculated using data collected over a full permit cycle. Data shall be collected and reported for the period of the permit cycle prior to permit renewal.

[c] The total removal efficiency for TSS is to be calculated on a mass balance basis as the percent of solids captured at the CSO Treatment Plant and then permanently removed at the West Point Treatment Plant based on the estimated removal efficiency at West Point.

[d] The maximum daily effluent concentration determined from a continuous measurement is calculated as the average of the pollutant concentrations measured over the day.

This report summarizes the performance and operation of the facility during June 2004 - May 2005.

Ecology requires the reporting of untreated/poorly treated events that are dropped from compliance calculations for CSO treatment facilities. The reporting must be done each year and must include data from the past 5 years. During the last 5-year window (June 1, 2000, through May 31, 2005), three events were dropped from the calculations of annual compliance of TSS and SS levels for the Alki Treatment Plant. Dropping these events resulted in less than one untreated event per year for that window.

Table 3 summarizes the annual performance data for the Alki Treatment Plant in the last 6 years (through May 31, 2005).

Table 3. Alki Plant Operating Data, October 1999 through May, 2005.

Year	Average TSS per Year (mg/l)	Average Settleable Solids per Year (ml/l/hr)	Discharge Flow per Year (MG)	Discharge Events per Year	*once per year untreated event
Oct 99-Dec 03	**Limit = 60 mg/l**	**Limit = 0.3 ml/l/hr**	**Limit = 108**	**Limit = 29**	
Oct 99 – May 00	26	0.15	4.0	2	No events removed
The above information was sent with the NPDES Renewal Package					
Jun 00 – May 01	No filling or discharge events				
Jun 01 – May 02	36	0.26	59.8	6	12/13/02 removed from avg. TSS and settleable solids calculation.
Jun 02 – May 03	33	<0.1	9.8	2	No events removed
Jun 03 – Dec 03	44	0.14	36.9	2	No events removed
Jan 04-May 05	**Limit = 50% removal**	**Limit = 0.3 ml/l/hr**	**Limit = 108**	**Limit = 29**	

Year	Average TSS per Year (mg/l)	Average Settleable Solids per Year (ml/l/hr)	Discharge Flow per Year (MG)	Discharge Events per Year	*once per year untreated event
Jan 04 - May 04	41 %	0.15	8.6	2	No events removed
Jun 04 – May 04	40 %	0.13	34.0	3	Nov-03 event removed from TSS calculation
Jun 04 – May 05	29 %	0.2	20.4	1	No events removed
Jun 04 – May 05	82 %	na	20.4	1	January event removed

There were two (2) inflow and one (1) discharge events at the Alki CSO facility between June 2004 and May 2005. The total number of gallons discharged to Puget Sound was well under the 108 MG annual limit and annual number of events was well under the limit of 29 events per year.

The Alki facility easily met the settleable solids permit conditions during this reporting year. This limit did not change with the new permit. Alki's effluent settleable solids averaged 0.2ml/l/hr during the reporting year. The highest monthly-average settleable solids concentration was 0.3 ml/l/hr, which also easily meets the permit limit of 1.9 ml/l/hr.

All six primary tanks were in operation throughout the events (and empty before each), along with their sludge collectors, sludge pumps and scum sprays. Hypochlorite was dosed at both the influent and effluent in order to maximize disinfection while trying to minimize effluent chlorine residual.

During the January 17 -18 storm, 3.31 inches of rain fell. Alki flows were estimated during this event from South Plant trends; totalized flows from data logger were not available. Instantaneous peak flows to Alki briefly reached 61 mgd and above. Annex pumps (i.e., the three fixed speed "stormwater" pumps that come into service after the three regular pumps are at full speed) at the 63rd Avenue Pump Station were subsequently shut down to avoid flooding the Alki facility. One untreated event occurred at 63rd as a result.

Table 4. Annual Suspended Solids Removal, 2004-2005.

Month	No. of Events	Alki Influent TSS lbs	Alki Effluent TSS lbs	Alki TSS removal %	Alki TSS to WP lbs	TSS removal at WP %	TSS as WP effluent lbs	Overall TSS removal %
June-04								
July-04								
August-04								
September-04								
October-05								
November-05								
December-04	1 (filling-only)	420	0	100%	420	82.2%	75	82.2%
January-05	1	18248	10962	39.9%	7286	69.8% avg.	2200	27.9%
February-05								
March-05								

Month	No. of Events	Alki Influent TSS lbs	Alki Effluent TSS lbs	Alki TSS removal %	Alki TSS to WP lbs	TSS removal at WP %	TSS as WP effluent lbs	Overall TSS removal %
April-05 May-05								
Total/Average		18668	10962	**41.3%**	7706		2275	**29.1%**
Total/Average dropping January event		420	0	**100%**	420		75	**82.2%**

Table 4 summarizes the performance of the Alki-WP CSO system during the storm events of 2004-05. The average TSS removal for 2004-05 fell well below the 50% removal requirement based on a mass balance calculation without dropping an event but met the limit with 82.2% TSS removal by dropping the January event as untreated/poorly treated. The average daily TSS removal at West Point to the TSS captured at Alki was applied in the overall removal calculation. For the next year's reporting period, the monthly average TSS removal from WP will be used as clarified in the June 20, 2005 modified permit.

It's interesting to note that TSS removal across Alki continues to be fairly similar from year to year during high flow events. For example, in 2002-03, TSS removal (across Alki only) averaged 39% while in 2003-04, TSS removal averaged 40%. In 2004-05, TSS removal across Alki was 39.9% for the only discharge event (Jan 18-19). By taking advantage of extra storage capacity in the West Seattle tunnel more of the flow – and so pollution - intended for treatment at the Alki CSO plant has been instead captured and transferred to West Point for better treatment. The side effect of this, however, has been to leave only the most dilute of the intended flows for treatment at Alki – flows which cannot average to 50% removal on their own. Much less pollution is being discharged than expected at Alki, but the percent removal calculation creates the impression of lower plant performance.

In 2004-2005, King County staff designed and added modifications to the disinfection system and added dechlorination equipment at Alki. These modifications will be necessary to meet the new permit conditions for fecal colifoms and effluent chlorine residual. The various modifications included the following:

- Installed hypochlorite injection points (with diffusers) in the 63rd Street pump station wet well (a.k.a. Alki Influent Pump Station). This new hypochlorite dosing location will increase the contact time for disinfection. New dosing pumps will also be installed for these injection pumps due to the increased headloss (due to the long pipe run). The existing injection location at the Alki headworks will still be available for dosing.
- Installed an additional chlorine residual analyzer downstream of the Alki bar screens to help control hypochlorite addition.
- Installed a temporary dechlorination facility consisting of a 500-gallon sodium bisulfite tank, two dosing pumps, and a chemical injection diffuser at the end of the chlorine contact channel.
- Relocated the existing chlorine analyzer just upstream of the sodium bisulfite diffuser in the contact channel. The analyzer can now draw from either the head of the chlorine contact channel or the effluent of Clarifier 6. This chlorine analyzer will be used to control sodium bisulfite addition.

- Raised the wall between the clarifier overflow channel and the contact channel with stop logs to prevent short circuiting.

Pilot studies are beginning in fall 2005 to determine whether the changes will result in consistent attainment of the new chlorine residual and fecal coliform limits, which go into effect January 2006.

Appendix B.
Carkeek CSO Plant Annual Report
June 2004–May 2005

This document constitutes the ninth annual report of the Carkeek plant as a CSO facility. Carkeek began to operate as a CSO facility on November 1, 1994. The facility currently operates under the permit for West Point Treatment Plant, Washington State Department of Ecology permit number WA-0029181-1, in effect from January 1, 2004 through December 31, 2008. Effective January 1, 2006, new permit limits for fecal coliform numbers and residual chlorine for Carkeek CSO discharges go into effect.

The permit limits are effective beginning January 1, 2006 through the end of the permit.

Parameter	Discharge Limitations (Monthly)	Discharge Limitations[a] (Yearly Average)	Discharge Limitations[b] (Long-term Average)
Total Suspended Solids Removal Efficiency[c]		50%	
Fecal Coliform Bacteria	2,800/100 mL geometric mean	NA	NA
Settleable Solids, ml/l/hr	1.9 Maximum	0.3	NA
Number of Events per year	NA	NA	10
Average Volume per year, million gallons	NA	NA	46 million gallons/year

Parameter	Average Monthly	Maximum Daily[d]
Total Residual Chlorine	NA	490 µg/L

[a] The yearly limitations will be calculated using per-event data points. Data shall be collected and reported on a schedule concurrent with the annual CSO report, June 1 to May 31, to include the entire wet season for purposes of determining compliance with these limitations.

[b] Long-term average will be calculated using data collected over a full permit cycle. Data shall be collected and reported for the period of the permit cycle prior to permit renewal.

[c] The total removal efficiency for TSS is to be calculated on a mass balance basis as the percent of solids captured at the CSO Treatment Plant and then permanently removed at the West Point Treatment Plant based on the estimated removal efficiency at West Point.

[d] The maximum daily effluent concentration determined from a continuous measurement is calculated as the average of the pollutant concentrations measured over the day.

The annual monitoring period is concurrent with the annual CSO reporting period, June 1 - May 31. This report summarizes the performance and operation of the facility during June 2004 - May 2005.

Performance for reporting period June 01, 04 through May 31, 05 (under the interim permit)

As of January 1, 2004, Carkeek effluent limits are defined as follows:

- Annual average **total suspended solids removal** is a **minimum of 50%**;
- **Maximum Settleable solids** is limited to **1.9 ml/l/hr or less as a monthly average**;
- **Settleable solids** is limited **an annual average of 0. 3 ml/l/hr or less**;
- During the permit cycle, the facility flow limits are an average of 10 events and an average of 46 million gallons per year, to be averaged over 5 years or the period of the permit if it were to be extended;

During the June 1, 2004 - May 31, 2005 period, there were 14 inflow events and 4 discharge events at the Carkeek CSO facility. The discharge event on August 22, 2004 was excluded in the annual average TSS and Settleable Solids calculations as the "one untreated discharge event per year" for measuring compliance for those parameters' respective permit limits. The discharge volume for this event was 0.03MG.

During this period:

1. The 5-year running average for the discharge events was 4.2 events/year, easily meeting the permit limit of 10 events/year;
2. The 5-year running average for the discharge volume was 14.1 MG/year, significantly lower than the permit limit of 46 MG/year;
3. The annual average TSS removal was 64.9%, meeting the permit limit of a minimum TSS removal of 50%, excluding the TSS removal data for August 22, 2004 discharge event as "one untreated overflow event per year". The annual average was 64.4% inclusive of the TSS removal data for August 22, 2004 event ;
4. The annual Settleable Solids concentration for the discharge events averaged 0.17 ml/l/hr met the permit limit of 0.3 ml/l/hr, excluding the data for August 22, 2004. The annual average, inclusive of all the discharge events, was 0.43 ml/l/hr.
5. None of the discharge events exceeded the Settleable Solids limit of 1.9 ml/l/hr, including the August 22, 2004 discharge event.

Ecology requires the reporting of untreated/poorly treated events. During the last 5-year window (June 1, 2000, through May 31, 2005), four events were considered as poorly treated and were therefore dropped from the calculations of annual compliance of TSS and SS levels for the Carkeek Treatment Plant. Dropping these events resulted in less than one untreated event per year for that window.

Ecology will review compliance performance at the end of the NPDES permit cycle as part of the permit renewal in 2008. Table 1 summarizes the Carkeek plant's annual performance to date (May 31, 2005) for the current 5-year permit period.

Table1:

Year	Annual Average TSS Removal (%)	Average SS per Year ml/l/hr	Discharge Flow per Year, MG	Discharge Events per Year	"once per year untreated event"
	Limit ≥ 50%	**Limit=0.3 ml/l/hr**	**Limit=46 MG/YR**	**Limit=10/yr**	
June 03-May 04	53	<0.10	27.19	4	10/20/03
June 04-May	64.9	0.17	4.04	4	8/22/04

05					
June 05– May 06					
June 06– May 07					
June 07– May 08					
Period to date average	N/A	N/A	15.62	4.2	

Operation and Maintenance

Pump set 2 was rebuilt in October 2004 and pump set 3 was rebuilt in February 2005. The pumps for the aeration tanks were replaced with self priming type pumps in late 2004. Pump set 1 replacement project will begin late fall 2005 and will be covered under the 2005-06 annual CSO report. The barscreen was rebuilt with a new drive unit and rake and put back into service in August 2005.

The sampling plan and procedures were reviewed at the annual refresher training held in October. Both Influent and Effluent samplers are scheduled to be purged weekly to keep them clean, operable and ready for an event. Staff will continue to make improvements in training, planning and documentation to maintain smooth operation of the Carkeek CSO Treatment Plant.

Carkeek Dechlorination Project:

King County staff has conducted a mechanical pilot test at Carkeek and Alki CSO storage facility in order to meet the new residual chlorine and coliform permit limits that will be going into effect on January 1st, 2006. The pilot test involved increasing the hypochlorite dosage to ensure adequately disinfecting the CSO flows, followed by de-chlorinating the flows using sodium bisulfite.

A five hundred gallon double-walled stainless steel tank was installed for storage of 38% bisulfite in the chemical feed room in the Operations Building. The chemical feed room has climate controls to ensure that the bisulfite does not freeze during cold weather. The storage tank is vented to a caustic impregnated carbon canister and out to the atmosphere. An 8-gal/hour Milton Roy diaphragm pump was installed for pumping the bisulfite required for dechlorination. A 30 psi C-2 water line with a solenoid valve supplies dilution water @ 15 gpm and is followed by a static mixer to ensure thorough mixing of bisulfite and water. The post-diluted bisulfite is conveyed through two-tiered diffuser at the head of the chlorine contact channel to inject bisulfite solution into the CSO flows during a discharge event.

The bisulfite on/off status is determined by the water level in the sedimentation tank and the flow. The out put of the pump is determined by the flow rate, intermediate chlorine residual and the sedimentation tank level. The bisulfite dosage is determined by multiplying the intermediate chlorine residual, the flow rate and a multiplying factor of 2. The multiplying factor of 2 is set higher than the stoichiometric ratio of 1.55 to build in a factor of safety.

Also, modifications were done to the disinfection pump controls as means of achieving high fecal kills during CSO events. An internal multiplier of 2.0 is activated for the first 30 minutes of each CSO event to double the dosage of hypochlorite since the CSO flows tend to be the strongest early into the storm event. The multiplier and of the length of time the internal multiplier stays active will be further optimized based on the data collected from actual storm events in the fall of 2005. Another modification involves maintaining the intermediate chlorine residual (measured at the head of sedimentation tank #1) at a minimum of 1.0 mg/l.

The construction phase of the pilot testing is over. The bisulfite system was tested out and the leaks were fixed. Dry run simulation of the dechlorination system was done in the first week of September. Full testing of the system is expected to take place as soon as the CSO season begins.